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10/587,971	03/05/2007	Masashi Tsuboi	294569US8PCT	7115

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EXAMINER	
PERROMAT, CARLOS	

ART UNIT	PAPER NUMBER
2628	

NOTIFICATION DATE	DELIVERY MODE
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	**Application No.**	**Applicant(s)**	
	10/587,971	TSUBOI ET AL.	
	Examiner	**Art Unit**	
	Carlos Perromat	2628	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *21 December 2010*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-8 and 10* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-8 and 10* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. Applicant's arguments filed 12/17/2010 have been fully considered but they are not persuasive.

Beginning at page 8 the Applicant repeats arguments analogous to those presented in the previous response: the Applicant argues that Payne is directed to positioning exit pupils within the system, which requires no moving parts. The Applicant justifies this position on the basis of a plurality of portions within Payne. The Applicant proceeds to cite: "[p]riority is **given to calculating and displaying the part of the display corresponding to the contributing region**." The Applicant then cites "the control means **determines the range of angles** that sub-regions of the display means must direct light into **to contribute to the image formed for the at least one viewing position and the pixel values of the display** means are calculated such that priority is given to directing light into said range of angles." Finally, the Applicant cites "the bandwidth (range of spatial frequencies) of the fringes and coded into each hogel (holographic element) would be determined by the limited range of angles that each hogel is required to direct light into for a given viewer position". The Applicant therefore concludes that Payne is directed to adjusting an angular range of a contributing region based upon monitoring the eye of the observer **without moving parts**.

The Applicant's representative insistence on differentiating that taught by Payne with respect to the instant invention on the basis of absence of moving parts cannot be understood. First, no moving parts are described are claimed within the invention The

Examiner remarks that the Applicant’s representative appears to misunderstand the nature of the imaging technology that is a kinoform, and how it creates holographic images. The Examiner directs the Applicant’s representative to the Applicant’s own disclosure, at page 9, lines 14-28. The Examiner further directs the Applicant to Yoshikawa, which the Applicant's representative states does not solve the alleged deficiencies of Payne with respect to the invention, particularly to Fig. 1, and text of page 864. The Applicant's representative will find the exact same holographic imaging system as disclosed by the Applicant. The Examiner would like to stress to the Applicant's representative that which both the Applicant's disclosure and Yoshikawa teach. A kinoform is a digital imaging component, composed of elements, in which amplitude or frequency is manipulated, with the result of a modified light transmission across each of the elements of the kinoform. This modified light transmission is received at a Fourier Lens at a focal distance, and is emitted from the Fourier lens to form an image at the same focal distance. The Fourier Lens is static. So is the focal distance. The elements that change in a kinoform display are the individual display elements within the kinoform. The variation in these elements is an electrical variation, as Yoshikawa clearly teaches (see page 863, second column), but also, most importantly the Applicant’s disclosure teaches (see page 7, second paragraph) modifying the characteristics of the element with respect to light transmission. The result is an image where variations in the elements of the kinoform cause the variations in the image components. This is clear within the Applicant’s disclosure, and clear within Yoshikawa. There are no movable parts within the kinoform display taught by the disclosure, and

the position of the Applicant's representative can only be understood as an involuntary misunderstanding of the nature of the invention. Even if one were to take the position that in Payne there are no moving parts where in the Applicant's somehow there are, the Examiner reminds the Applicant that, again, Yoshikawa teaches the same kinoform, Fourier lens imaging system as that in the invention, including simulated annealing, which consists in randomly assigning solutions and progressively refining the criteria upon the randomized solutions are accepted or rejected, as explained by the Applicant's disclosure as known in the art and cited in the rejection and as explained by Yoshikawa. Further, the Examiner directs the Applicant to Payne's description of the device used for the display, at par. [0038] “a spatial light modulator means”, at par. [0068] to pixels within a pixelated liquid crystal light modulator, and finally, par. [0082] teaches a system equivalent to that taught both by the Applicant and Yoshikawa; as can be seen in Fig. 2. Yoshikawa explicitly teaches using a “spatial light modulator” liquid crystal (see page 863, col. 2).

Further, the Examiner remarks that Payne is not used in isolation within the rejection, but in combination of AAPA and Yoshikawa. As shown above, Payne is directed to holographic displays equivalent or analogous to those in AAPA and Yoshikawa, and the Examiner has made the reasoning for combining AAPA, Yoshikawa and Payne explicit in the rejection, which the Applicant's response does not address.

The Applicant's arguments are respectfully considered unconvincing and the rejection for all claims maintained, modified exclusively to accommodate the Applicant's amendment.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1-8 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over the applicant's admitted prior art (p.1, lines 14-29, p.2, lines 1-29, p.3, lines 1-29 and p. 4, lines 1-10 of the specification of the instant application; "AAPA" hereinafter) in view of Yoshikawa et al. (N. Yoshikawa and T. Yatagai; "Phase Optimization of a Kinoform by Simulated Annealing"; Applied Optics, Vol. 33, No. 5; February 1994; supplied by the applicant; "Yoshikawa" hereinafter), and further in view of Payne et al. (U.S. patent Publication No. 2004/0021768; "Payne" hereinafter).

Regarding claim 1, AAPA teaches a three-dimensional image display device for displaying a three-dimensional image by irradiating illuminating light at an optical wavefront control unit which records a control image (p. 1, lines 1-20), comprising: a control image optimizing unit configured to calculate three-dimensional images corresponding to a group of control images, select a control image corresponding to the three-dimensional image satisfying a predetermined condition from the group of control images, and record the selected control image on the optical wavefront control unit (see p. 2, lines 2-29 and p. 3, lines 1-4 for a thorough description of the Simulated Annealing method which consists on the steps described).

AAPA does not teach that the constraints are information regarding the optical wavefront unit. Yoshikawa however discloses a method of optimizing phase of a kinoform using a Simulated Annealing method such as that described in AAPA (see Introduction, 2nd and 3rd par. for Simulated Annealing) where the kinoform is optimized to adjust to the characteristics of the optical control medium (see Introduction, 3rd par.; see Section 4, 3rd par. for using the modulation characteristics of the control unit in order to improve irregularities obtained when this characteristic is not considered). Because both AAPA and Yoshikawa teach devices that optimize a kinoform using the Simulated Annealing method, it would have been obvious to one of ordinary skill in the art at the time of the invention to use the display characteristics of the display unit when performing Simulated Annealing optimization for the reasons disclosed by Yoshikawa and discussed above.

AAPA and Yoshikawa further teach that the optical wavefront control unit has a display device recording the control image (in Yoshikawa, see page 863, 2nd col., 2nd par.).

AAPA and Yoshikawa teach that the predetermined condition is information regarding an optical wavefront control unit (see discussion above for using the modulation characteristics of the control unit). AAPA and Yoshikawa do not explicitly teach the predetermined condition is also a condition restricting a region to be calculated of a three-dimensional image of each pixel of a control image recorded in the optical wavefront control unit on a control image basis, where the region to be

calculated is a region of the three-dimensional image affected by change of a pixel on the optical wavefront unit.

Payne however teaches a three-dimensional display in which calculations are minimized by taking into account only the range of angles that cause an effect (see abstract; see par. [0033]; see par. [0093] for using this limitation in calculation by determining the originating elements in the control device that affect a region and further speeding calculations by limiting the range of angles that each holographic element is required to direct light into). Since Payne teaches reducing calculations by processing only data relevant to an appropriate output region, and AAPA teaches the computational intensity of the Simulated Annealing method (see p. 2, line 29 and p.3 lines 1-5), it would have been obvious to one of ordinary skill in the art to use the association of control elements and output region taught in Payne with the Simulated Annealing method taught in AAPA and Yoshikawa in order to reduce calculations to the portions of the image affected by each iterative change, as taught by Payne; the Examiner further notes that it is very well-known in the art that each image element is considered a pixel (a picture element), and also, from the discussion above, that simulated annealing requires calculations on a control image basis. While Payne limits the region that is to be calculated to the region that would be visible to a specific viewer, see par. [0093], par. [0004] clearly shows that it is known in the art to perform calculation based on the angle of view for a specific viewer or alternatively, for a plurality of viewers. Therefore, since Payne teaches limiting the calculations for each pixel in the image on the basis of the effect the pixel has on the image as seen by a user, but also teaches that it is known

in the art to perform calculations for images that need to be seen by a plurality of users, it would have been obvious to one of ordinary skill in the art at the time of the invention faced with the challenge of optimizing computation as taught by Payne for an image to be seen by a plurality of users of positions unknown to limit the calculation for each pixel on the basis of the changes the pixel makes on the image as seen by any possible spectator, thereby limiting the calculation for each pixel to the region of the 3D image affected by the pixel as seen from any possible or predictable viewer.

AAPA, Yoshikawa and Payne further teach that the group of control images is based on information regarding the optical wavefront control unit in the form of constraints specifying a region of a three-dimensional image on which change of a pixel on the optical wavefront control unit has an effect; that the control image optimizing unit is configured to calculate a three-dimensional image (g(x, y) with the inside of the visual region defined by the characteristics of a display device as a region to be calculated for each pixel of the initial solution U(K,l) (in Payne, see par. [0084] for calculating for every pixel the variation of the transmission of light to create the plurality of points in the object that is to be represented; see discussion above for taking into account the constraints of the display and for limiting the calculation to only areas that are viewable and how it renders obvious limiting to the region that the pixel can display; further, see par. [0090] for the calculations that can be used to determine based on the area of a display the size of the area generated; applying said formula to calculating, based on a known pixel area the area of the image upon which the pixel has an effect is straightforward; in Yoshikawa, see page 864, 1st col. for formulae defining the original solution, see 2nd col.

and workflow for determining iteratively the solution; see page 863, 2nd col. 2nd par. for using a liquid-crystal spatial modulator that modifies pixel frequency).

AAPA, Yoshikawa and Payne further render obvious that the size of the visual region formed by illuminating light of intensity above a certain level reaching the reconstructed image display unit is determined based on the amplitude of illuminating light passing through each pixel (see discussion above for using frequency passing through each pixel to regulate the visual region; in AAPA; see p. 1, lines 14-20 for controlling either phase or amplitude distribution in order to generate the image; in Yoshikawa, see page 864, 1st col. second paragraph for how errors in the solution are caused by neglecting the amplitude variation occurring with frequency modulation, which is corrected by the simulated annealing method; see immediately preceding par. for calculating the intensity; the Examiner considers clear within Yoshikawa that in the correction, the amplitude modulation of the incoming light across the display elements is taking into consideration when calculating the solution required to display the image, and therefore incorporated into the solution algorithm, thereby also taken into account when calculating the area of the image, as discussed above; see Fig. 7 for taking into account said modulation in terms of voltage applied for both amplitude and phase).

Finally, AAPA, Yoshikawa and Payne do not explicitly teach that each pixel in the control image has a uniform size; the Examiner however notes that this is the most usual case for pixelated displays, taught explicitly by Yoshikawa and Payne, and therefore that one of ordinary skill in the art would have that to be an implicit teaching in both of the references; further, the Examiner considers that one of ordinary skill in the

art at the time of the invention would have certainly realized that using pixels of different sizes complicates calculations since it requires mapping the respective pixels to their sizes when calculating the required images, and further since it would result in different effective resolutions for different image areas, built into the device and not modifiable.

Regarding claim 2, AAPA, Yoshikawa and Payne further teach that the control image optimizing unit is configured to generate the group of control images by sequentially performing change processing on part of the control image, and sequentially calculate the three-dimensional images based on difference information about the control images before and after the change processing (in AAPA, see p. 2, lines 2-5 and p. 3, lines 1-5).

Regarding claim 3, AAPA, Yoshikawa and Payne do not explicitly disclose that the control image optimizing unit is configured to calculate the three-dimensional image in a region to be calculated defined by the constraints. Payne however teaches a three-dimensional display in which calculations are minimized by taking into account only the range of angles that cause an effect (see abstract; see par. [0033]; see par. [0093] for using this limitation in calculation by determining the originating elements in the control device that affect a region). Since Payne teaches reducing calculations by processing only data relevant to an appropriate output region, and AAPA teaches the computational intensity of the Simulated Annealing method (see p. 2, line 29 and p.3 lines 1-5), it would have been obvious to one of ordinary skill in the art to use the association of control elements and output region taught in Payne with the Simulated Annealing

method taught in AAPA and Yoshikawa in order to reduce calculations to the portions of the image affected by each iterative change, as taught by Payne.

Regarding claim 4, AAPA, Yoshikawa and Payne further teach that the control image is constituted by phase distribution of an optical wavefront (in AAPA, see p. 1, lines 21-26); and the control image optimizing unit is configured to calculate the region to be calculated, based on a range in which phase modulation is possible on a display device constituting the optical wavefront control unit, and accuracy of the phase modulation (see discussion for claims 1, 2 and 3 above; in Yoshikawa, see Fig. 7 for the phase modulation and discussion above to account for this effect).

Regarding claim 5, AAPA, Yoshikawa and Payne further teach that the control image optimizing unit is configured to calculate the region to be calculated, also taking account of amplitude modulation which occurs with the phase modulation (see discussion for claims 1, 2 and 3 above; in Yoshikawa, see Fig. 7 for amplitude modulation, and discussion above to account for this effect).

Regarding claim 6, AAPA, Yoshikawa and Payne further teach that the control image is constituted by amplitude distribution of an optical wavefront; and the control image optimizing unit is configured to calculate the region to be calculated based on a range in which amplitude modulation is possible on a display device constituting the optical wavefront control unit, and accuracy of the amplitude modulation (see discussion for claims 1, 2 and 3 above; in AAPA; see p. 1, lines 14-20 for controlling either phase or amplitude distribution. Although the Simulated Annealing method is discussed with respect to phase distribution the Examiner notes that the method only describes a

pseudo-random optimization method to solve computationally difficult problems by using progressively narrow tolerances, and that it would have been obvious to one of ordinary skill in the art at the time of the invention to use such method to adjust amplitude in the same manner as adjusting phase; Yoshikawa, see Fig. 7, for amplitude and phase modulation).

Regarding claim 7, AAPA, Yoshikawa and Payne further teach that the control image optimizing unit is configured to calculate the region to be calculated also taking account of phase modulation which occurs with the amplitude modulation (see discussion for claims 1, 2 and 3; in Yoshikawa, see Fig. 7 for amplitude and phase modulation).

Regarding claim 8, AAPA, Yoshikawa and Payne teach a three-dimensional image display method for displaying a three-dimensional image by irradiating illuminating light at an optical wavefront control unit having a display device recording a control image, comprising: calculating three-dimensional images corresponding to a group of control images based on information regarding the optical wavefront control unit in the form of constraints specifying a region of a three-dimensional image on which change of a pixel on the optical wavefront control unit has an effect; selecting a control image corresponding to the three-dimensional image satisfying a predetermined condition from the group of control images; and displaying the selected control image on the optical wavefront control unit, wherein three-dimensional images (g(x, y)) are calculated with the inside of the visual region defined by the characteristics of a display device as a region to be calculated for each pixel of the initial solution (U(k, l), pixels

constituting a control image have a uniform size, and the size of the visual region formed by illuminating light of intensity above a certain level reaching a reconstructed image display unit is determined based on the amplitude of illuminating light passing through each pixel (see discussion for claim 1, above).

Regarding claim 10, AAPA, Yoshikawa and Payne further teach that the control image optimizing unit is configured to determine the region to be calculated, based on a range in which phase modulation is possible on the display device constituting a part of the optical wavefront control unit and the accuracy of phase modulation (see discussion for claim 1, above, for using the constraints inherent to the display device; in Yoshikawa, see page 863, first col. for maximum phase modulation of the kinoform; see page 864, 1st col., 2nd par. for taking into account the limited precision of the kinoform from quantization in order to approximate a better reconstructed image).

Conclusion

4. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any

extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Carlos Perromat whose telephone number is (571) 270-7174. The examiner can normally be reached on M-TH 8:30 am- 5:00 pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kee M. Tung can be reached on (571)272-7794. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Kee M Tung/
Supervisory Patent Examiner, Art Unit 2628

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Examiner
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C.P.